Remarks

Claims 9 and 11 have been amended, and claim 10 has been canceled. Claims 1-9 and 11-12 remain in the application, and re-examination and reconsideration of the application are respectfully requested.

Claims 1 and 9 are rejected under 35 U.S.C. §102(b) as being anticipated by Smith et al. Smith et al. relates to the field of generating activated gas containing ions and an apparatus for processing materials with activated gas. Summarizing Smith et al. at col. 1, line 66 - col. 2, line 31, it is known that plasmas can be generated in various ways including DC discharge, radio frequency (RF) discharge, and microwave discharge. RF discharges and DC discharges inherently produce high energy ions, and microwave discharges produce dense, low ion energy plasmas. However, microwave and inductively coupled plasma sources require expensive and complex power delivery systems. These plasma sources require precision RF or microwave power generators and complex matching networks to match the impedance of the generator to the plasma source. In addition, precision instrumentation is usually required to ascertain and control the actual power reaching the plasma.

Smith et al. provides an improved toroidal low-field plasma source with an ignition control that allows plasma ignition in a wider range of gas conditions than are permitted generally by the prior art plasma sources, for example, a microwave discharge. Referring to Fig. 1, a toroidal low-field plasma source 10 includes a power transformer 12 that couples electromagnetic energy into a plasma 14. The power transformer 12 includes a high permeability magnetic core 16, a primary coil 18, and a plasma chamber 20. The plasma chamber 20 allows the plasma 14 to form a secondary circuit of the transformer 12. The power transformer 12 can include additional magnetic cores and conductor primary coils (not shown) that form additional secondary circuits. The plasma chamber 20 can be formed from a metallic material such as aluminum or a refractory metal, or can be formed from a dielectric material such as quartz. A sample holder 23 can be positioned in the process chamber 22 to support the material to be processed. The material to be processed can be biased relative to the potential of the plasma.

The plasma source 10 also has a switching power supply 250 that includes a voltage supply 24 directly coupled to a switching circuit 26 containing a switching semiconductor device 27. The voltage supply 24 can be a line voltage supply or a bus

voltage supply. The switching semiconductor device 27 can be a set of switching transistors. The switching circuit 26 can be a solid state switching circuit. An output 28 of the circuit 26 can be directly coupled to the primary winding 18 of the transformer 12. In addition, the plasma source 10 can include a power control circuit 42 that accepts data from one or more of the current probe 38, the power detector 40 and the circuit 26 and then adjusts the power in the plasma by adjusting the current in the primary winding 18.

Using the Smith et al. switching power supply in a toroidal low-field plasma source is advantageous because switching power supplies are much less expensive and are physically much smaller in volume and lighter in weight than the prior art RF and microwave power supplies used to power plasma sources. This is because switching power supplies do not require a line isolation circuit or an impedance matching network, col. 11, lines 1-8.

Thus, while Smith et al. identifies microwave discharge as a known method of producing a plasma, the Smith el al. invention shown and described with respect to Figs. 1-16 utilizes a switching circuit 26 to produce high voltage pulses to the plasma chamber and avoids the use of the more complex and expensive microwave power delivery system. Applicants submit that the Office Action incorrectly identifies element 14 in Fig. 1 as a microwave generator. Element 14 is a plasma that is produced by a ionization process as described col. 7, lines 42-57. Applicants further submit that Smith et al. does not describe, suggest or motivate one to use a microwave generator and lamp with a high voltage power supply, current limiting device, fault detector and control as recited in claim 1. Therefore, Applicants submit that claims 1 and 9 are patentable and not anticipated under 35 U.S.C. §102(b) by Smith et al.

Claims 1 and 9 are rejected under 35 U.S.C. §103(a) as being unpatentable over Pratt et al. (U.S. Patent No. 5,642,268) in view of the Applicant Admitted Prior Art (AAPA), which pursuant to a telephone conference with the Examiner on December 14, 2005, was identified as Kyong-keun (U.S. Patent No. 5,224,027) referenced at col. 3, lines 5-10 of Pratt et al.

Referring to Fig. 3 of Pratt et al., a power supply circuit 90 receives an AC input from an AC input device 92 such as a supply of 120 volts AC. An AC to DC converter 94 converts the AC line input to a DC output of approximately 400 volts DC on the

output lines 96 and 98. The AC to DC converter also provides for power factor correction. The DC output lines are connected to the input of a switching regulator section 100 which converts the 400 volts DC to a second DC voltage whose amplitude is controllable based on the sensed operating conditions of a magnetron 102. This second DC voltage appears at the output lines 104 and 106 which are coupled to a high voltage and filament section 108. The high voltage and filament section 108 converts the controllable DC voltage appearing at the output lines 104 and 106 to an AC wave form which is then passed through a transformer and reconverted to a full wave rectified DC output at the output lines 110 and 112 which are respectively coupled to the cathode and anode of the magnetron 102.

An induced ramping or saw-tooth voltage function is generated at the output lines 110 and 112 and is monitored by a voltage sensing circuit to determine when the voltage applied to the magnetron reaches a certain level. If the ramping voltage exceeds a predetermined level, the switching regulator section 100 is turned off, according to a signal received from the voltage feed back circuit 114, so that the ramping voltage appearing at output lines 110 and 112 begins to fall. At the same time, a current sense circuit 116 monitors the current flow through the magnetron 102. Once the magnetron is operating at the correct frequency and correct output power, as shown by current flow, the current sense device 116 signals the switching regulator 100, thereby indicating that the proper current has been reached. Once the current is determined to be in the proper operating range, the power supply circuit 90 shifts to a constant current source and the magnetron continues to operate at the correct frequency range. By changing from the voltage control mode to the current control mode, the power level can be adjusted.

Kyong-keun relates to a switch mode power supply that is used to drive a magnetron. Referring to Fig. 1, a PWM control 80 applies switching control pulses to a switching means 90 that, in turn, controls voltages applied to a magnetron 50. A first feedback means 30 provides feedback voltages from a transformer 20 driving the magnetron 50. A current detecting transformer 60 provides feedback voltages to a second feedback means 70 that, in turn, operates the PWM control 80 as determined by the feedback voltages from the first and second feedback means 30, 70. Therefore, as described at col. 3 lines 33-63, as voltage from the magnetron increases, current

applied to the current detecting transformer 60 increases; and the pulse width of the PWM control 80 is controlled, for example, reduced. Thus, the switching cycle of the switching means 90 is stabilized, for example, the duty cycle reduced; and the voltage supplied to the magnetron is stabilized. Thus, Kyong-keun provides a switch mode power supply (SMPS) system that protects the magnetron from overcurrents.

In order to establish a prima facie case of obviousness, it is necessary that the Office Action present evidence, preferably in the form of some teaching, suggestions or incentives or inference in the applied prior art or, in the form of generally available knowledge, that one having ordinary skill in the art would have been led to arrive at the claimed invention.

Applicants submit that a prima facie case of obviousness is not made because Pratt et al. in view of Kyong-keun does not teach, suggest or motivate one to provide the following elements.

First, claims 1 and 9 require a current limiting device connected between the high voltage power supply and the microwave generator. As noted in the Office Action, Pratt et al. does not disclose a current limiting device. Further, Kyong-keun describes a SMPS system in which a current feedback from the output of the high voltage power supply is used to control switching of a PWM control 80 and switching means 90. Kyong-keun does not describe, suggest or motivate one to connect a current limiting device between the high voltage power supply 20, 40 and the magnetron 50 as required by claims 1 and 9.

Second, claims 1 and 9 require that a control interrupt a connection between an AC power source and the high voltage power supply in response to an error signal representing a supply of an excessive current to the microwave generator. Pratt et al., in Fig. 3, shows a switching regulator section 100 that regulates a DC voltage from an AC-DC converter 94 and provides the regulated DC voltage to a high voltage section 108 of power supply 90 circuit. The switching regulator 100 is incapable of disconnecting the AC input 92 from the power supply circuit 90 as required by claims 1 and 9. Similarly, there is no description, suggestion or motivation in Kyong-keun to provide a control operative to interrupt a connection between the AC input and the rectifier means 10.

In view of the above, Applicants submit that claims 1 and 9 are patentable and not obvious under 35 U.S.C. §103(a) over Pratt et al. in view of AAPA, that is, Kyong-keun.

Applicants submit that claims 2-8 are dependent on allowable claim 1; and claims 11-12 are dependent on allowable claim 9; and therefore, Applicants submit that claims 2-8 and 11-12 are patentable and not obvious under 35 U.S.C. §103(a) over Pratt et al. in view of Kyong-keun and/or any of the other cited references.

Applicants submit that the application is now in condition for allowance and reconsideration of the application is respectfully requested. The Examiner is invited to contact the undersigned in order to resolve any outstanding issues and expedite the allowance of this application.

Respectfully submitted,

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